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tude, the Arctic Circle and 68° north latitude. The sedimentary rocks are divided into undifferentiated Paleozoic metamorphic schists, undifferentiated Paleozoic limestones, Silurian limestone, Upper Devonian limestone, Mississippian beds (Noatak sandstone, Lisburne limestone), a probable Jurassic Anaktuvuk group, a Lower Cretaceous or Upper Jurassic Koyukuk group, an Upper Cretaceous Bergman group, Eocene conglomerate, Pleistocene, and Recent. The igneous rocks consist of greenstones (pre-Carboniferous), probable Jurassic basic intrusives, flows, and tuffs, granitic intrusives (pre-Upper Cretaceous), and late Tertiary to Recent basaltic flows and volcanic ash. Deformation followed by erosion occurred previous to the deposition of the undifferentiated Paleozoic limestones. A period of deformation closed the Mississippian. The present topographic features were produced after the deposition of part of the Eocene. A series of east-west folds, broken by faults, affect the eastern part of the area, while north-south folds and faults are present in the western part. Auriferous gravels of notable production occur in the Shungnak and Squirrel River regions. There are gold and copper sulphide lodes, which have not as yet been developed to the producing stage.

V. O. T.

A Geological Reconnaissance of the Fairbanks Quadrangle, Alaska.

By L. M. PRINDLE. With a Detailed Description of the Fairbanks District, by L. M. PRINDLE and F. J. KATZ. And an Account of Lode Mining near Fairbanks, by PHILIP S. SMITH. Bull. U.S. Geol. Surv. No. 525, 1913. Pp. 216.

The Fairbanks quadrangle, which forms a portion of the central plateau province of Alaska, lies between 64° and 66° north latitude and 146° and 150° west longitude. The most prominent structures are northeast-southwest trending close folds. The oldest rocks belong to the pre-Ordovician (?) Birch Creek schist; separated by an unconformity, a series of Paleozoic rocks (Ordovician to Carboniferous) follow. Unconformities also exist between the Silurian and early Devonian, between later Devonian and probable Pennsylvanian rocks, between the Upper Cretaceous and older rocks, and between the Upper Cretaceous and probable Eocene lignite-bearing beds. The occurrence of greenstones (basic volcanic lavas and tuffs), which are probably in the main of Devonian age, is interesting inasmuch as similar rocks appear in many parts of Alaska which are apparently of about the same age. The intrusion of granites and diorites succeeded the deposition of the Pennsylvanian strata. In one locality a basalt flow of probable Tertiary age was noted.

In the detailed description of the Fairbanks district are brought out the facts that this district lies wholly within the area of the Birch Creek schist, that great intrusions of diorite, granite, porphyries, and dikes occurred probably at the close of the Mesozoic, and that the auriferous and other deposits are genetically related to the intrusions. Gold placers have been developed on a

large scale in the Fairbanks district. These produced in 1912 gold to the value of \$4,370,000 and silver to the value of \$31,203. The development of the placers, according to F. J. Katz, has been chiefly by drift-mining methods, although open-cut mining is practiced in shallow ground. P. S. Smith in his discussion of lode mining notes that practically all of the developed veins are free-milling gold lodes, and that six properties are producing and have their own mills. The estimated production for 1912 from the lodes was \$200,000. It is believed that this production will increase with the introduction of improved methods and more extensive development.

V. O. T.

The Koyukuk-Chandalar Region, Alaska. By A. G. MADDREN.
Bull. U.S. Geol. Surv. No. 532, 1913. Pp. 116.

The Koyukuk-Chandalar region is bounded by 146° and 154° west longitude and the Arctic Circle and 68° north latitude. The main purpose of this report is to describe that portion of the area in which gold placers have been developed. The oldest strata are of sedimentary origin and Paleozoic age. These include the pre-Ordovician (?) Birch Creek schist, Devonian (?), and Carboniferous (?) beds. Cretaceous beds represent the Mesozoic sediments, and Tertiary and Quaternary deposits the Cenozoic. Granitic and dioritic intrusions (mostly of Mesozoic age) are associated with the Birch Creek schist; basic igneous rocks and tuffs occur with the Devonian (?); some volcanic rocks are present in the Cretaceous; the youngest igneous rocks are effusives, basaltic and andesitic lavas, and tuffs of Quaternary or Tertiary age. Unconformities are recognized between the pre-Ordovician (?) and Devonian (?); between the Carboniferous (?) and Cretaceous; between the Cretaceous and Tertiary; between the Tertiary sediments and the Quaternary or Tertiary igneous rocks; between these igneous rocks and the Pleistocene; and between the Pleistocene and Recent. The dominant structural lines trend a little north of east. The older schists are closely folded, while the Paleozoic series is thrown up into more open folds with many faults. The Mesozoic and Tertiary sediments are locally folded and faulted. Placer gold is, at present, the only mineral of commercial importance in the Koyukuk district. The gold occurs in the present stream deposits and bench deposits and has been derived chiefly from the Birch Creek schist. Surface mining methods are employed. In general, the yearly production of the Koyukuk district has gradually increased during the last ten years; the total estimated production up to 1912, inclusive, is \$2,700,000. No lodes of commercial value have been found. In the Chandalar district probably "the most promise lies in its known quartz-lode gold deposits," since the placers are poor and local. The lodes are associated with diorite intrusions into the schist. Because of the difficulty of transportation of machinery and supplies, no producing mines are in operation.

V. O. T.